

Original Research Article

Effects of Ganoderma Lucidum (Red Reishi mushroom) on the Genital System in Female Rats

Dilek Burukoglu Donmez* and Göksen Yılmaz

Abstract

Eskisehir Osmangazi University,
Department of Histology and
Embryology, Eskisehir, Turkiye

*Corresponding Author Email:
dburukoglu@yahoo.com; Tel:
Tel:90.222.2392979-4464

Ganoderma lucidum, is a mushroom used for alternative medicine worldwide particularly in China, also known as “Immortality Mushroom”. Traditional medicines usually contain a single active compound, and it is well-known that this single-compound has been found to be efficient and safe in preclinical models and several animal studies. The present study aimed to investigate the effects of Ganoderma lucidum (Red Reishi mushroom) on female genital system histologically by light microscopy. 40 female Sprague-Dawley rats weighing 200-250g were used in the experiments. Study animals were divided into 4 groups as control, Ganoderma lucidum, Ganoderma lucidum + vitamine C, and vitamine C groups. The results of the present study revealed no unfavorable effects of Ganoderma lucidum on rat female genital system at that dose and duration of exposure.

Keywords: Ganoderma lucidum, vitamine C, rat, female genital system, light microscopy.

INTRODUCTION

Ganoderma Lucidum is a mushroom species that is called Reishi in Japanese, Ling Zhi in Chinese, and Ganoderma Lucidum in Latin and that is also known by the name “Mushroom of Immortality” in numerous countries around the World (Chang and Buswell 1996). Ganoderma species are not included in the edible mushroom groups due to their thick, hard fruit body. About 250 taxonomic names have been reported around the world so far that falls within the Ganoderma species. Chemical components of Ganoderma Lucidum are comprised of complex carbohydrates, proteins, nucleic acids, triterpenoids, sterols, fatty acids, betain, vitamins, and other trace elements (Güzeldağ 2007). Animal experiments conducted for defining pharmacological characteristics of the mushroom and observations of individuals using them clearly reveals that some components of Ganoderma possesses some important bioactivity (Chang and Buswell 1996; Müller et al. 2006; Uysal 2006). Among the chemical components of Ganoderma Lucidum, polysaccharides especially include

anticancer activity. Polysaccharides are organic structures that are difficult to be absorbed in the body. The absorption of polysaccharides increases thanks to vitamin C taken along with Ganoderma Lucidum, and thus, Ganoderma Lucidum demonstrates a much better effect. Vitamin C has a structure similar to glucose and which other six carbon monosaccharides, molecular formula of which is C₆H₈O₆ and is soluble in water. In humans, other primates, and guinea pigs, it is not synthesized in the body; therefore, human beings must take vitamin C with diet (Kayaalp 2000; Niki 1991). Vitamin C can easily be oxidized to dehydroascorbic acid even without catalytic mediation of an enzyme. Highest amount of vitamin C is found in such citrus fruits as lemon, orange, and grapefruit (Kayaalp 2000). Vegetables with green leaves, tomato, rosehip fruit, green pepper, cabbage, grapes, strawberry, melon, watermelon, banana, and new potatoes also contain vitamin C. Studies conducted on the species have been focused rather on such organs as liver and kidneys.

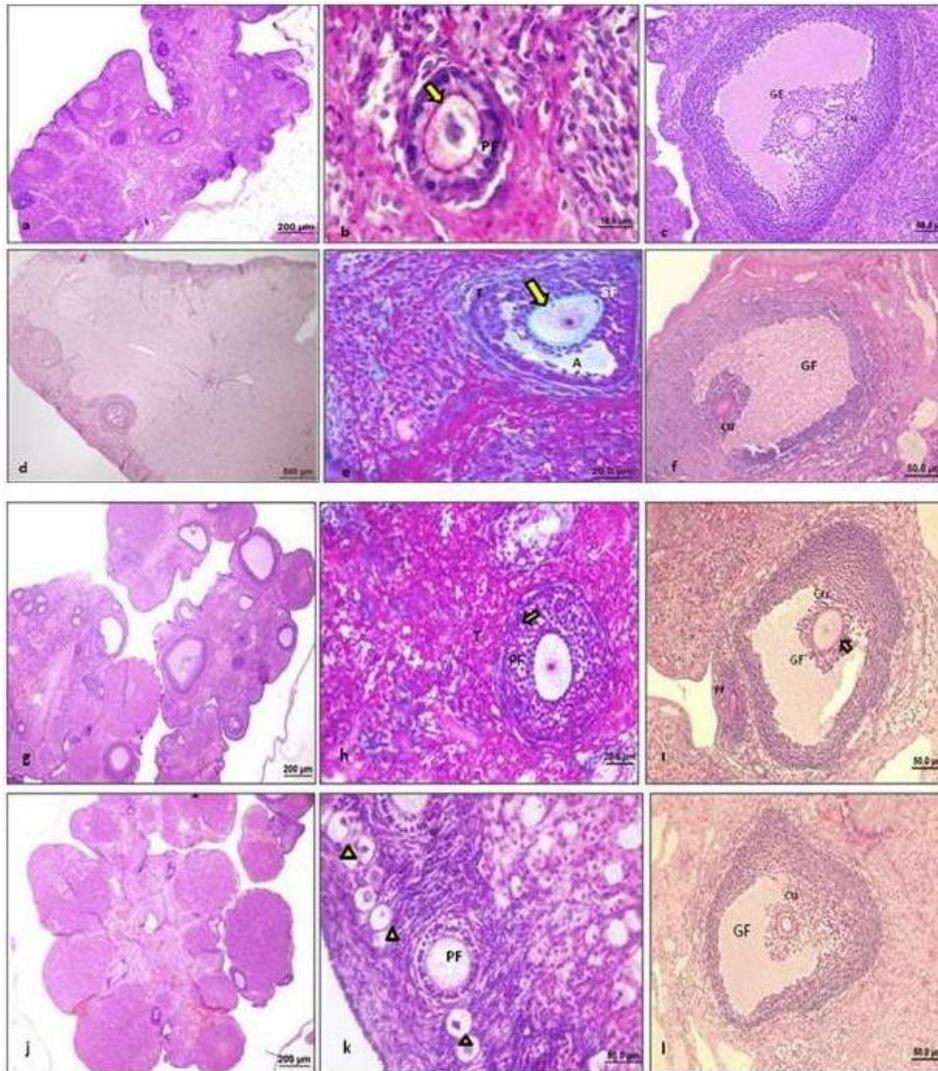


Figure 1. Ovaries of experimental animals that comprise control group (a,b,c), vitamin C group (d,e,f), Ganoderma Lucidum (g,h,i), and Ganoderma Lucidum+Vitamin C (j,k,l) group are observed in normal histological structure. Primordial follicle (▶), secondary follicle (SF), primary follicle (PF), Graaf follicle (GF) structure, antrum (A), cumulus oophorus cells (cu), zona pellucida structure (yellow arrow) (HE, PAS+H, Masson's Trichrome), (bar:200μm, bar:500μm, bar:10.0μm, bar:20.0μm, bar:50.0μm).

Thus, the effects of Ganoderma Lucidum on female genital system have yet to be revealed. In this study that was carried out with reference to this information, it was aimed to analyze the effects of Ganoderma Lucidum mushroom species on female genital system at a light microscopic level and to shed light on the path of new researches.

MATERIAL AND METHODS

40 adult female Sprague-Dawley rats with weights ranging between 200±250 grams were used in this study. Experimental animals were divided into 4 main groups.

Control Group

A total of 10 rats were given normal saline for 15 days through gavage at doses determined by estimating the volume according to their individual body weights.

Ganoderma Lucidum Group

A total of 10 rats were given Ganoderma Lucidum extract (600mg/kg) for 15 days through gavage (Lin and Lin 2006; YouGuo et al. (2009).

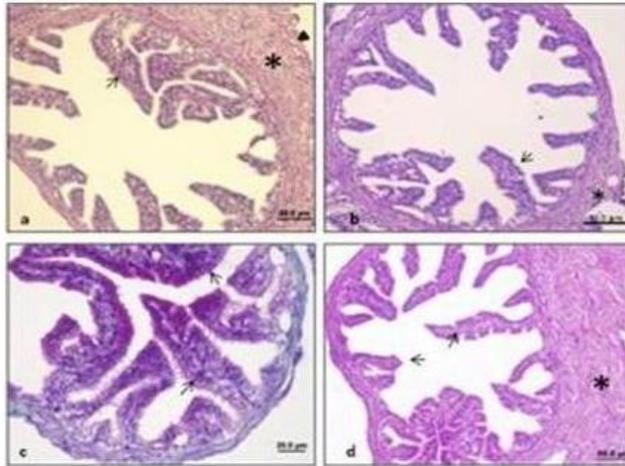


Figure 2. Tuba uterina of experimental animals that comprise control group (a), vitamin C group (b), Ganoderma Lucidum (c), and Ganoderma Lucidum+Vitamin C (d) group are observed in normal histological structure. Tunica mucosa; epithelium (→) and lamina propria, tunica muscularis (*), and tunica serosa (▶). (HE, PAS+H, Masson's Trichrome), (bar:20.0µm, bar:50.0µm)

Vitamin C Group

A total of 10 rats were given vitamin C (100mg/kg) for 15 days intraperitoneally (Niki 1991).

Ganoderma Lucidum + Vitamin C Group

A total of 10 rats were given Ganoderma Lucidum extract (600mg/kg) through gavage and vitamin C (100mg/kg) intraperitoneally for 15 days (Lin and Zhang 2004).

Ganoderma Lucidum extract used in the experiment and produced by GanoTurk Company from dried mushroom slices were brought to boil in distilled water in a glass container according to dose. After boiling process began, the heat was then reduced and it was left to simmer for at least 60 minutes. The extract prepared by also taking into consideration the vaporization was given to rats at equal amounts (10cc) for 15 days through gavages. Absolutely no metal containers were used for boiling process. Injections and gavage were conducted at the same hour (between 10:00am and 12:00pm) every day. At the end of the 15-day experiment, rats were anesthetized by administering i.p Ketamine 50mg/kg + Xylazine 10mg/kg and abdominal region of the animals were then opened. Ovary, uterus, and tuba uterine were removed and fixated in 10% formaldehyde and turned into paraffin blocks following routine procedures. Serial sections of 2µm thickness were taken from the tissues from which paraffin blocks were prepared. In order to reveal the general structures and characteristics of the tissues, the sections were stained by Masson's Trichrome, Periodic Acid Schiff (PAS)-Hematoxylin (H)

and Hematoxylin-Eosin (H-E).

RESULTS

Control Group

In microscopic analyses conducted on rat ovaries, ovaries were established to be in normal histologic structure including epithelial, follicular structures and other formations (Figure 1a-c). Tuba uterine was observed to be in normal histologic structure (Figure 2a). Uterus was also observed to be in normal histologic structure including endometrium, myometrium, and perimetrium layers, and the entire formations found within (Figure 3a).

Vitamin C Group

Ovaries were found to be similar to control group considering its entire structures (Figure 1d-f). When analyzed the tuba uterina sections, tunica mucosa, tunica muscularis, and tunica serosa layers were observed to be similar to control group (Figure 2b). Uterus was observed to be similar in structure to control group along with endometrium, myometrium, and perimetrium layers, and entire formations found within (Figure 3b).

Ganoderma Lucidum Group

No histopathological findings were observed in either

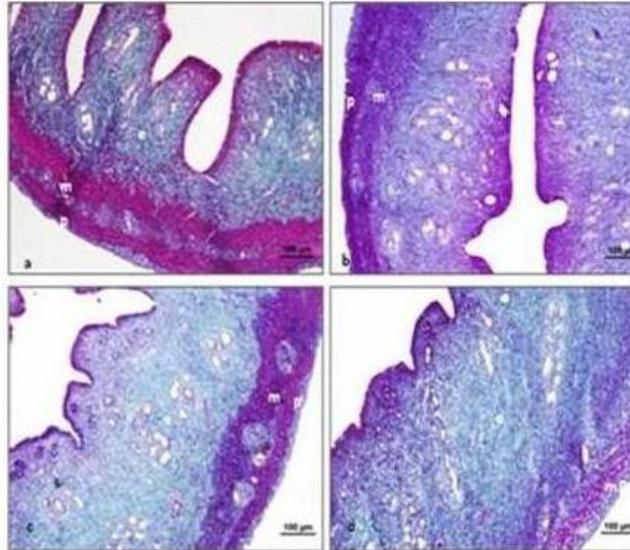


Figure 3. Uteri of experimental animals that comprise control group (a), vitamin C group (b), Ganoderma Lucidum (c), and Ganoderma Lucidum+Vitamin C group (d) are observed in normal histological structure along with endometrium (e), myometrium (m), perimetrium layer (p), and all the structures within these layers. (Masson's Trichrome), (bar:100 μ m).

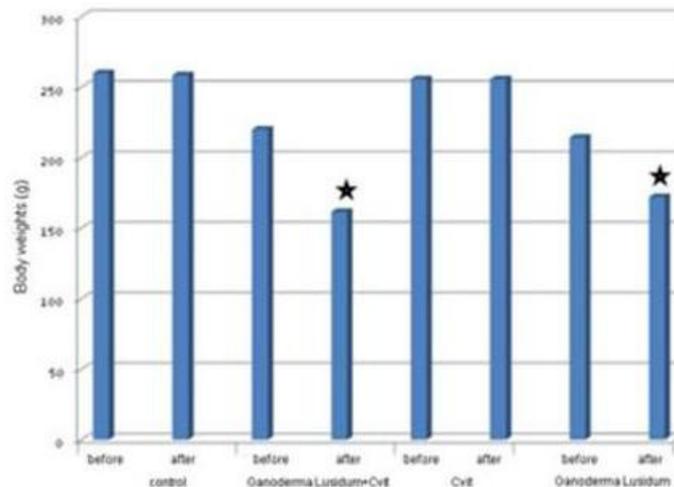


Figure 4. Pre- and post-experimental body weight differences between rats ($p < 0.05 = *$)

follicular structures or other formations of ovaries. Structures and counts of primordial, primary, secondary, and Graaf follicles were similar with control group (Figure 1g-i). When analyzed the sections of tuba uterina, tunica mucosa, tunica muscularis, and tunica serosa layers were observed to be close to the ones in the control group. No histopathological findings were observed (Figure 2c). Uterus endometrium, myometrium, and perimetrium layers and the entire formations within were found to be similar to control group. No histopathological findings were observed (Figure 3c).

Ganoderma Lucidum + Vitamin C group

Any histopathological finding was not observed in ovaries in the entire preparations. Structures and counts of primordial, primary, secondary, and Graaf follicles were similar with the control group (Figure 1j-l). Tuba uterina, tunica mucosa, tunica muscularis, and tunica serosa layers were observed to be close to the ones in the control group. No histopathological findings were observed (Figure 2d). Uterus was observed to be similar in structure to control group along with endometrium,

myometrium, and perimetrium layers, and entire formations found within. No histopathological findings were observed (Figure 3d).

When checked the body weights, no change was observed before or after the experiment in the control group and vitamin C group. A statistically significant decrease was observed in Ganoderma Lucidum and Ganoderma Lucidum+vitamin C groups before and after the experiment ($p<0.05$ -Figure 4).

DISCUSSION

Ganoderma Lucidum provides individuals with disease resistance by activating neuroendocrine and immune systems through natural active substances it contains. The facts that it especially possesses antitumor activity, cardiovascular effects, and antihepatotoxic activities increase the scientific attention drawn to it (Kim et al. 2007; Lin and Lin 2006). In literature, there are references as to its benefits of the consumption of the water of Ganoderma Lucidum mushroom as prepared by cutting it into small pieces and boiling in water for at least two hours (Balın 2007; Chang and Buswell 1996). In our research, dried fruit of Ganoderma Lucidum were purchased and the extract of the mushroom was obtained by boiling in distilled water for 60 minutes. Polysaccharides in Ganoderma were left to fragment during the boiling period. In order to facilitate the fragmentation of polysaccharides, rats used in the experiment were intraperitoneally given vitamin C. According to literature, vitamin C facilitates the passage of polysaccharides that has bigger molecules through cell membrane (Chang and Buswell 1996). In our study in which we analyzed the effect of Ganoderma Lucidum extract on female genital system, any negative effect on ovary, tuba uterine, and uterus was not observed. Therefore, we believe that our study will shed light on researches to be conducted at enzymatic, biochemical, and immunohistochemical level in terms of the use of the said mushroom species which could have remarkable benefits as supporting agent in the treatment of numerous diseases.

CONCLUSIONS

In terms of the body weights of experimental animals that were given 600mg/kg Ganoderma Lucidum extract for 15

days through gavage measured at the beginning and the end of the experiment, a decrease in the body weights of rats belonging to Ganoderma Lucidum experiment group and Ganoderma Lucidum + vitamin C experiment group was observed compared to pre-experiment body weights. Thus, it was established that Ganoderma Lucidum caused a significant reduction in body weight. In the assessment histologically conducted between the groups, ovary, tuba uterine, and uterus tissues of all the groups were observed to be in a histologic structure similar to control group. We believe that it would be possible to analyze Ganoderma Lucidum in more detail and to reveal its mechanisms in a more clear way through such advanced studies as biochemical analyses, immunohistochemistry, and also cell culture, all to be conducted in combination, in order to use it as drug.

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